



An illustrated checklist of Malpighiaceae from the Chapada dos Veadeiros region, Goiás, Brazil

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Abstract: An updated checklist of Malpighiaceae from the Chapada dos Veadeiros region, Goiás, Brazil, is presented. We recorded 78 species of this family of plants, which represent a higher diversity than previously reported for the region. About one third of all the Malpighiaceae species recorded for the Cerrado are found within the area, which shows the important role of the Chapada dos Veadeiros region in the conservation of this family in Central Brazil.

Key words: *Banisteriopsis*, *Byrsonima*, Cerrado, Chapada dos Veadeiros National Park, floristic studies, *Heteropterys*, Malpighiales

INTRODUCTION

Malpighiaceae is one of the most diverse families of tropical and subtropical lianas and shrubs worldwide (Anderson 2004). It is easily recognized by the presence of malpighiaceae hairs (unicellular hairs that bear a foot and two branches), a pair of oil secreting glands at the base of each sepal (elaiophores), and unguiculate petals with a very conspicuous claw (Anderson 1981). The family comprises approximately 75 genera and 1,300 pantropical species, predominantly distributed within the Neotropics, which holds 90% of this family's diversity (Davis and Anderson 2010; Anderson 2013). In Brazil, Malpighiaceae is represented by 44 genera and approximately 561 species distributed throughout the country. However, the family is especially diverse within the Cerrado region, a hotspot for conservation priorities that possesses 233 species (Mittermeyer et al. 2005; Mamede et al. 2015).

The Cerrado is a tropical savanna that covers

approximately 23% of the Brazilian territory and shows different soil types, phytophysiognomies and geological formations (Eiten 1972; IBGE 2012). Although the Cerrado is not an exclusive phytogeographic domain in Brazil, a high rate of endemism is present in the majority of its extent within Brazil (Forzza et al. 2012). Likewise, the Cerrado is regarded as a hotspot for conservation priorities due to its great biological diversity and high number of endemics species, approximately 44% of its species, some of which are endangered (Mittermeyer et al. 2005). One of the most important remnants of the Cerrado vegetation in Brazil is the Chapada dos Veadeiros region, situated next to crop farms in Central Brazil, with most of its diversity confined to the Chapada dos Veadeiros National Park. The area within this federal conservation unit comprises a great number of endemic species (Silva and Bates 2002) and different Cerrado phytophysiognomies such as rocky fields (Campos Rupestres), grasslands and swampy grasslands (Veredas; Munhoz and Felfili 2006; Felfili et al. 2007).

Although the family Malpighiaceae is diverse within the Cerrado vegetation in Brazil (Mamede et al. 2015), few checklists and taxonomic studies focusing on this group are available in the literature. Most of these studies considered the diversity of species that occur along the Espinhaço Mountain Range (Mamede 1987, 1990, 2004; Juncá et al. 2005; Volpi 2006), with the exception of Felfili et al. (2007), who presented a checklist for the Chapada dos Veadeiros region mainly based on herbaria specimens.

The Malpighiaceae is diverse in the Cerrado, and the Chapada dos Veadeiros National Park remains as a major continuous fragment of the Cerrado in Central Brazil. Thus, we present an updated checklist of the Malpighiaceae within the Chapada dos Veadeiros region.

MATERIAL AND METHODS

Study site

The Chapada dos Veadeiros region is located in northeastern Goiás state, between latitudes 13–15° S and longitudes 047–049° W. It comprises the municipalities of Alto Paraíso de Goiás, Cavalcante, Colinas do Sul, São João D'Aliança and Teresina de Goiás (Figure 1; Felfili et al. 2007; Oliveira 2007). This region is located in a highland complex, with altitudes ranging from 500–1,650 m, and a variety of poor and low depth soils covered by different phytophysognomies (Munhoz and Felfili 2006; Felfili et al. 2007). The annual mean rainfall ranges from 1,500 to 1,750 mm, and the annual mean temperature from 24–26°C (Silva et al. 2001; for detailed pedologic and climatic descriptions of this region, see Felfili et al. 2007).



Figure 1. Phytophysognomies of the Chapada dos Veadeiros region. **A:** General view of the Cerrado in the municipality of Alto Paraíso de Goiás. **B:** Gallery forest in the municipality of Colinas do Sul. **C:** General view of the Cerrado in the municipality of Alto Paraíso de Goiás (District of São Jorge). Photos by C.V. Silva.

Data collection

A total of six field expeditions were carried out between 2007 and 2014 to elaborate the checklist of Malpighiaceae that occur within the Chapada dos Veadeiros region. Specimens were collected and prepared for the herbarium according to usual techniques (Bridson and Forman 1992) and were deposited in the collections of different herbaria (CGMS, HUEFS, SP and UFG). In addition, we analyzed the collections deposited

in the CEN, CEPEC, CGMS, CPAP, HEPH, HUEFS, MBM, RB, SP, SPF, UB and UFG herbaria (acronyms according to Thiers 2014). For the elaboration of the checklist, we selected a voucher, preferably from personal collections and from information stored at the Species Link (2014) database when the voucher was identified by taxonomic specialists of the Malpighiaceae.

RESULTS

A total of 78 species belonging to 15 genera of Malpighiaceae were found. The most representative genera were *Byrsonima* Rich. ex Kunth (20 spp.), *Banisteriopsis* C.B. Rob. ex Small (17 spp.) and *Heteropterys* Kunth (14 spp.), followed by *Peixotoa* A. Juss. (7 spp.), *Camarea* A. St. Hil. (6 spp.), *Tetrapteryx* Cav. (4 spp.) and *Diplopteryx* A. Juss. (2 spp.). In contrast, the genera *Aenigmatanthera* W. R. Anderson, *Dicella* Griseb., *Hiraea* Jacq., *Janusia* A. Juss., *Mascagnia* Bertero, *Niedenzuella* W. R. Anderson, *Pterandra* A. Juss. and *Stigmaphyllon* A. Juss. were represented by a single species (Table 1; Figures 2–5). *Banisteriopsis caapi* (Spruce ex Griseb.) Morton was not included in the present list because it is known to be a cultivated species, native to the Amazon forests (Mamede et al. 2015). Likewise, *Camarea affinis* A. St. Hil. × *hirsuta* A. St. Hil. is recognized as a native species of the Chapada dos Veadeiros region, but it was not included on the species list because it is a hybrid.

Approximately 34 species recorded for the Chapada dos Veadeiros region are endemic to the Brazilian Cerrado, and 38 species are widespread in Brazil, i.e., they occur in more than one phytogeographic domain, according Mamede et al. (2015). Among the endemic species of the Brazilian Cerrado, three occur only in the Chapada dos Veadeiros region, namely *Banisteriopsis hatschbachii* B. Gates, *Camarea humifusa* W.R. Anderson and *Peixotoa anadenanthera* C.E. Anderson. Moreover, *Banisteriopsis cipoensis* B. Gates, *Banisteriopsis hatschbachii* B. Gates and *Banisteriopsis hirsuta* B. Gates are considered endangered according to Amorim et al. (2013) because they are present with a restricted distribution and occur in areas subject to fire and human activities.

DISCUSSION

A total of 27 new records of Malpighiaceae were added to a previous checklist for the Chapada dos Veadeiros region elaborated by Felfili et al. (2007), which cited a total of 57 species. Those authors cited the occurrence of eight species of Malpighiaceae for the Chapada dos Veadeiros region that are not listed here, i.e., *Banisteriopsis angustifolia* (A. Juss.) Gates, *Byrsonima arctostaphyloides* Nied., *B. crassa* Nied., *B. dealbata* Griseb., *B. ligustrifolia* A. Juss., *Carolus chlorocarpus* (A. Juss.) W.R. Anderson, *Heteropterys tomentosa* A. Juss. and *Stigmaphyllon paralias* A. Juss. The species *B. arctostaphyloides* and *B. crassa* are the respective synonyms

Table 1. Checklist of Malpighiaceae species that occur in the Chapada dos Veadeiros region. Geographic distribution according Mamede et al. (2015) and Species Link (2014): EC= endemic to Cerrado; EV= endemic to Chapada dos Veadeiros; W= widespread (occur in more than one phytogeographic domain). Species marked with asterisk (*) are considered endangered according Amorim et al. (2013).

Species	Voucher	Distribution	Species	Voucher	Distribution
<i>Aenigmatanthera lasiandra</i> (A. Juss.) W.R. Anderson	Saavedra 480 (RB)	W	<i>Camarea ericoides</i> A. St.-Hil.	Francener 1018 (UFG)	EC
<i>Banisteriopsis anisandra</i> (A. Juss.) B. Gates	Silva 660 (UB)	EC	<i>Camarea hirsuta</i> A. St. Hil.	Irwin 24545 (UB)	EC
<i>Banisteriopsis argyrophylla</i> (A. Juss.) B. Gates	Anderson 6350 (UB)	EC	<i>Camarea humifusa</i> W.R. Anderson	Anderson 11465 (MBM)	EV
<i>Banisteriopsis campestris</i> (A. Juss.) Little	Anderson 11481 (UB)	W	<i>Camarea sericea</i> A. St.-Hil.	Francener 1019 (UFG)	EC
<i>Banisteriopsis cipoensis</i> B. Gates*	Irwin 12419 (SP)	EC	<i>Dicella macroptera</i> Mart. ex A. Juss.	Ratter 7328 (UB)	W
<i>Banisteriopsis gardneriana</i> (A. Juss.) W.R. Anderson & B.Gates	Francener 1011 (UB)	W	<i>Diplopterys lutea</i> (Griseb.) W.R. Anderson & C.C. Davis	Forzza 1625 (CEPEC)	W
<i>Banisteriopsis hatschbachii</i> B. Gates*	Irwin 12419 (UB)	EV	<i>Diplopterys pubipetala</i> (A. Juss.) W.R. Anderson & C.C. Davis	Francener 1014 (CGMS)	W
<i>Banisteriopsis hirsuta</i> B. Gates*	Gates 224 (UB)	EC	<i>Heteropterys byrsonimifolia</i> A. Juss.	Sebastiani 218 (SP)	EC
<i>Banisteriopsis irwinii</i> B. Gates	Gates 212 (UB)	EC	<i>Heteropterys campestris</i> A. Juss.	Anderson 7280 (UB)	EC
<i>Banisteriopsis laevifolia</i> (A. Juss.) B. Gates	Anderson 6504 (UB)	W	<i>Heteropterys cochleospesma</i> A. Juss.	Sebastiani 222 (SP)	EC
<i>Banisteriopsis latifolia</i> (A. Juss.) B. Gates	Ratter 7353 (UB)	EC	<i>Heteropterys dumetorum</i> (Griseb.) Nied.	Mamede 69A (SP)	EC
<i>Banisteriopsis malifolia</i> var. <i>appressa</i> B. Gates	Anderson 6686 (UB)	W	<i>Heteropterys eglandulosa</i> A. Juss.	Anderson 7359 (UB)	W
<i>Banisteriopsis megaphylla</i> (A. Juss.) B. Gates	Anderson 7357 (UB)	EC	<i>Heteropterys escalloniifolia</i> A. Juss.	Sebastiani 211 (SP)	W
<i>Banisteriopsis oxyclada</i> (A. Juss.) B. Gates	Anderson 7360 (UB)	W	<i>Heteropterys nervosa</i> A. Juss.	Hatschbach 54557 (CEPEC)	W
<i>Banisteriopsis schizoptera</i> (A. Juss.) B. Gates	Ginzburg 730 (UB)	W	<i>Heteropterys nitida</i> (Lam.) DC.	Anderson 6366 (UB)	W
<i>Banisteriopsis stellaris</i> (Griseb.) B. Gates	Anderson 6393 (UB)	W	<i>Heteropterys pannosa</i> Griseb.	Francener 1009 (UB)	EC
<i>Banisteriopsis variabilis</i> B. Gates	Sebastiani 226 (SP)	EC	<i>Heteropterys pteropetala</i> A. Juss.	Irwin 24811 (UB)	EC
<i>Banisteriopsis vernoniifolia</i> (A. Juss.) B. Gates	Anderson 6671 (UB)	W	<i>Heteropterys rubiginosa</i> A. Juss.	Hatschbach 70332 (RB)	W
<i>Byrsonima basiloba</i> A. Juss.	Anderson 6406 (NY)	EC	<i>Heteropterys xanthophylla</i> A. Juss.	Filgueiras 3285 (SP)	EC
<i>Byrsonima chrysophylla</i> Kunth	Silva 3311 (SP)	W	<i>Heteropterys</i> sp.1	Francener 1242 (SP)	-
<i>Byrsonima clauseniana</i> A. Juss.	Sebastiani 206 (SP)	EC	<i>Heteropterys</i> sp. 2	Santin 575 (SP)	-
<i>Byrsonima coccolobifolia</i> Kunth	Francener 1030 (CGMS)	W	<i>Hiraea cuiabensis</i> Griseb.	Walter 980 (CEPEC)	EC
<i>Byrsonima crassifolia</i> (L.) Kunth	Francener 1263 (SP)	W	<i>Janusia mediterranea</i> (Vell.) W.R. Anderson	Hatschbach 60197 (CEPEC)	W
<i>Byrsonima cydoniifolia</i> A. Juss.	Oliveira 98 (SP)	W	<i>Mascagnia cordifolia</i> (A. Juss.) Griseb.	Anderson 6583 (UB)	W
<i>Byrsonima guilleminiana</i> A. Juss.	Hatschbach 36806 (MBM)	EC	<i>Niendenzuella multiglandulosa</i> (A. Juss.) W.R. Anderson	Pereira da Silva 5690 (SP)	W
<i>Byrsonima intermedia</i> A. Juss.	Irwin 22565 (UB)	W	<i>Peixotoa anadenanthera</i> C.E. Anderson	Kameyama 147 (SP)	EV
<i>Byrsonima lancifolia</i> A. Juss.	Anderson 6598 (UB)	EC	<i>Peixotoa glabra</i> Griseb.	Soares e Silva 1084 (UB)	EC
<i>Byrsonima linearifolia</i> A. Juss.	Fonseca 5871 (SP)	EC	<i>Peixotoa goiana</i> C.E. Anderson	Ferreira 10 (UB)	EC
<i>Byrsonima oblongifolia</i> A. Juss.	Anderson 6210 (UB)	W	<i>Peixotoa hatschbachii</i> C.E. Anderson	Toledo 105 (SP)	EC
<i>Byrsonima pachyphylla</i> A. Juss.	Francener 1027 (CGMS)	W	<i>Peixotoa magnifica</i> C.E. Anderson	Ferreira 217 (UB)	EC
<i>Byrsonima rigida</i> A. Juss.	Mamede 55 (SP)	EC	<i>Peixotoa reticulata</i> Griseb.	Ferreira 12 (UB)	W
<i>Byrsonima rotunda</i> Griseb.	Gates 220 (SP)	W	<i>Peixotoa tomentosa</i> A. Juss.	Sebastiani 210 (SP)	EC
<i>Byrsonima sericea</i> DC.	Sebastiani 190 (SP)	W	<i>Pterandra pyroidea</i> A. Juss.	Francener 1031 (UFG)	EC
<i>Byrsonima subterranea</i> Brade & Markgr.	Francener 1032 (UFG)	W	<i>Stigmaphyllon paraense</i> C.E. Anderson	Pereira-Silva 4920 (CEPEC)	W
<i>Byrsonima umbellata</i> A. Juss.	Gomes-Klein 2444 (UB)	W	<i>Tetrapteryx ambigua</i> (A. Juss.) Nied.	Francener 1023 (CGMS)	EC
<i>Byrsonima vacciniifolia</i> A. Juss.	Barbosa 194 (SP)	W	<i>Tetrapteryx jussieuana</i> Nied.	Francener 1020 (CGMS)	W
<i>Byrsonima verbascifolia</i> (L.) DC.	Francener 1033 (UFG)	W	<i>Tetrapteryx microphylla</i> (A. Juss.) Nied.	Francener 1264 (SP)	W
<i>Byrsonima viminifolia</i> A. Juss.	Francener 1266 (SP)	EC	<i>Tetrapteryx ramiflora</i> A. Juss.	Forzza 1602 (CEPEC)	W
<i>Camarea affinis</i> A. St.-Hil.	Anderson 6639 (UB)	EC			
<i>Camarea axillaris</i> A. St.-Hil.	Hatschbach 60327 (CEPEC)	EC			

of *B. vacciniifolia* A. Juss. and *B. pachyphylla* A. Juss. mentioned here, while *B. ligustrifolia* is reported only for the Atlantic forest (Mamede et al. 2015). The collections from the Chapada dos Veadeiros region related to the others species were not found in any of the consulted herbaria, which included the same collections analyzed by Felfili et al. (2007).

About a third of all Malpighiaceae species that occur in the Cerrado are found in the Chapada dos Veadeiros region. This same pattern is reported for different groups of flowering plants in this region, such as *Mimosa* L. (Fabaceae; Simon and Proença 2000) and *Syagrus* Mart. (Arecaceae; Martins 2012). However, the Chapada dos

Veadeiros region is currently undergoing expansion of crop farms, an intensive extraction of plants for craft works, and the devastation of forests on mesotrophic soils (Felfili et al. 2007).

The great diversity of Malpighiaceae species within the Chapada dos Veadeiros region might be explained by different factors such as the elevation of the terrain and the spatial heterogeneity of the biota because there are different phytophysiognomies in this region (Felfili et al. 2007). The significant diversity of the genus *Byrsonima* was expected because it is one of the largest genera of Malpighiaceae with regards to number of species and the most diversified within the Cerrado and the



Figure 2. **A:** *Aenigmatanthera lasiandra*. **B:** *Ae. lasiandra*. **C:** *Banisteriopsis anisandra*, **D:** *B. argyrophylla*. **E:** *B. campestris*. **F:** *B. gardneriana*. **G:** *B. laevifolia*. **H:** *B. malifolia*. **I:** *B. megaphylla*. **J:** *B. oxyclada*. **K:** *B. schizoptera*. **L:** *B. stellaris*. **M:** *B. variabilis*. **N:** *B. vernoniifolia*. **O:** *Byrsonima basiloba*. **P:** *Byrsonima cydoniifolia*. Photos by C.F. Hall, R.F. Almeida, J. Santos, O. Marques, N. Silva and L.C. Marinho.

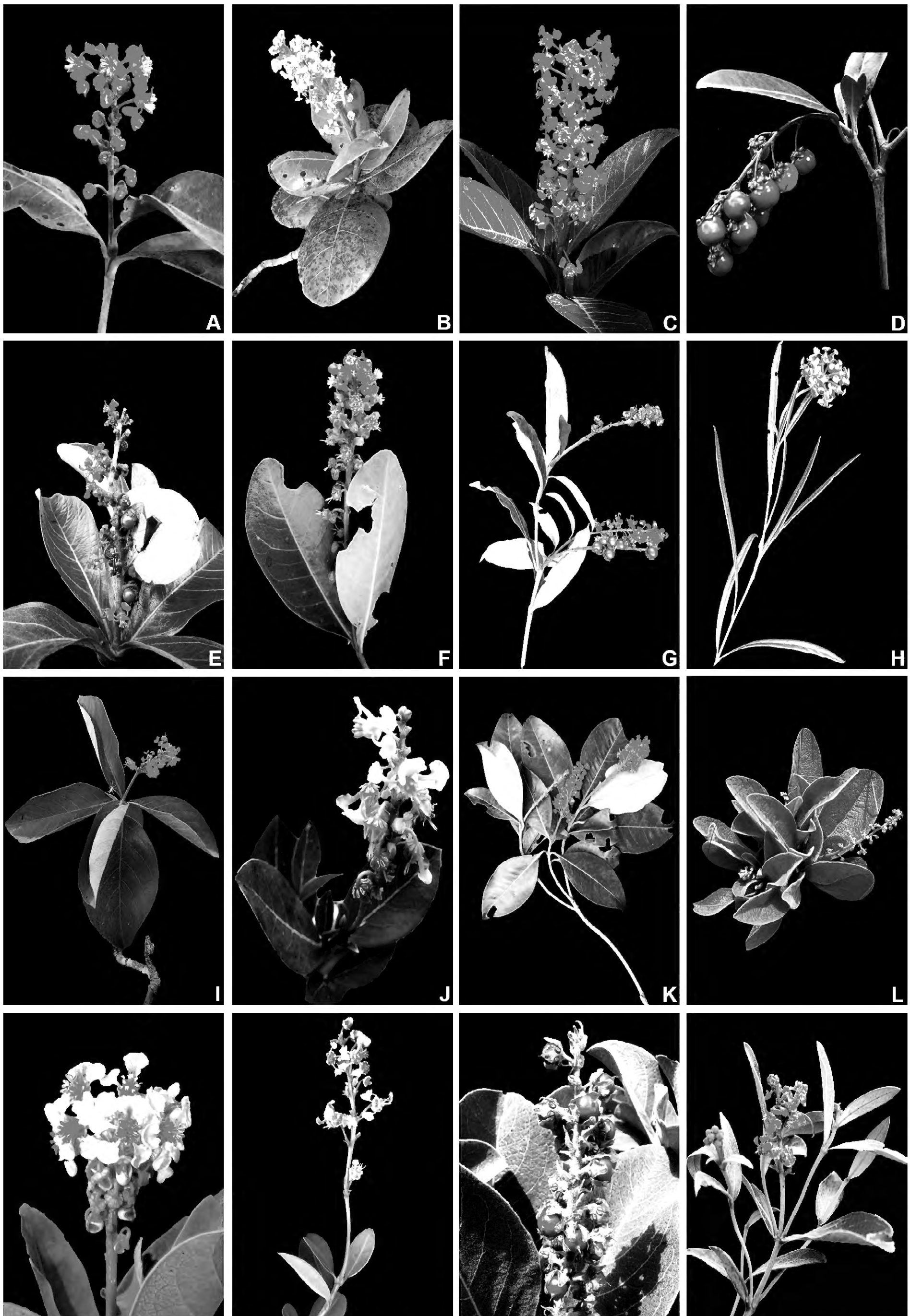


Figure 3. **A:** *Byrsonima chrysophylla*. **B:** *B. coccolobifolia*. **C** and **D:** *B. crassifolia*. **E:** *B. guilleminiana*. **F:** *B. intermedia*. **G:** *B. lancifolia*. **H:** *B. linearifolia*. **I:** *B. pachyphylla*. **J:** *B. rigida*. **K:** *B. sericea*. **L:** *B. subterranea*. **M:** *B. umbellata*. **N:** *B. vacciniifolia*. **O:** *B. verbascifolia*. **P:** *B. viminifolia*. Photos by C.F. Hall, R.N. Junior, G.S. Siqueira and R.F. Almeida.

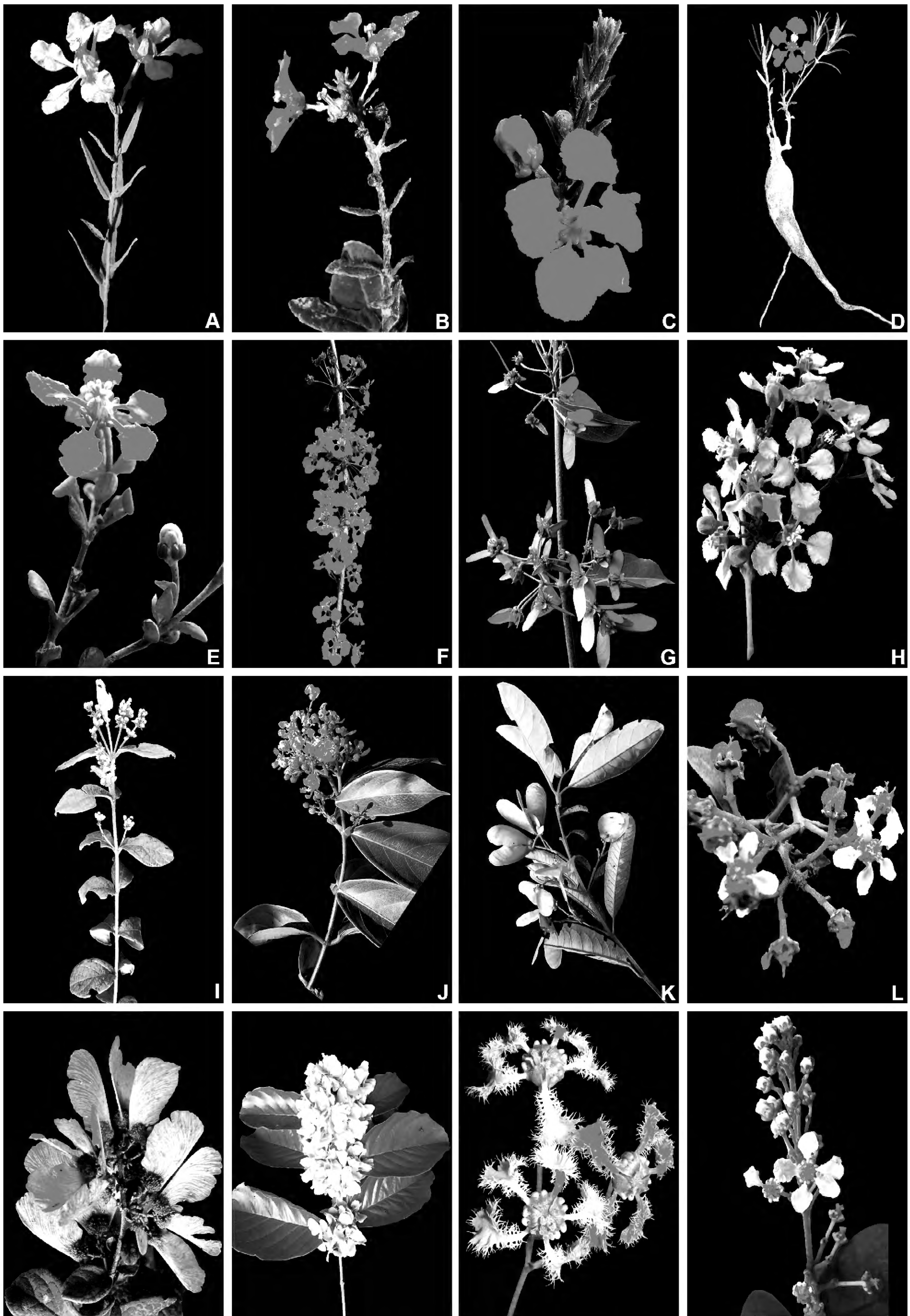


Figure 4. **A:** *Camarea affinis*. **B:** *C. affinis* x *hirsuta*. **C:** *C. ericoides*. **D:** *C. sericea*. **E:** *Dicella macroptera*. **F:** *Diplopterys lutea*. **G:** *Diplopterys pubipetala*. **H:** *Heteropterys byrsonimifolia*. **I:** *H. campestris*. **J:** *H. eglandulosa*. **K:** *H. nitida*. **L:** *H. pteropetala*. **M:** *H. rubiginosa*. **N:** *Hiraea cuiabensis*. **O:** *Janusia mediterranea*. **P:** *Mascagnia cordifolia*. Photos by C.F. Hall, J. Lovo, L.C. Marinho, G.S. Siqueira, R. Santin and R.F. Almeida.



Figure 5. A: *Niedenzuella multiglandulosa*. B: *Peixotoa glabra*. C: *P. goiana*, D. *P. reticulata*. E: *P. tomentosa*. F: *Pterandra pyroidea*. G: *Tetrapteryx ambigua*. H: *T. jussieuana*. I: *T. microphylla*. J: *T. ramiflora*. Photos by C.F. Hall, C. Siva, R. Santin, F. Flores and R.F. Almeida.

Amazon Forest (Mamede et al. 2015). The same pattern is observed for the genus *Banisteriopsis* because most of its Brazilian species (32 of 47 species) are confined to the Cerrado (Mamede et al. 2015), and 17 species are recorded for the Chapada dos Veadeiros in the present study. In contrast, the number of *Heteropterys* species from the Chapada dos Veadeiros in the present study does not keep this proportion because 97 species are recognized in Brazil, but we only found 14 species in the Chapada dos Veadeiros region. A higher number for *Heteropterys* species was expected because this genus is more diverse in the Atlantic Forest (50 spp.) and the Cerrado (34 spp.) than in the Amazon Forest (14 spp.; Mamede et al. 2015). However, the expeditions within

the study area and the visits to the different herbaria allowed us to recognize two new species of *Heteropterys*.

The Cerrado has lost approximately 55% of its original area due to human impacts, and only small protected remnants of this phytogeographic domain remain (Klink and Machado 2005). In the last 30 years, a progressive mechanization with improved techniques for clearing and fertilizing the lands within the Cerrado has contributed to an accelerated destruction of the natural vegetation (Simon and Proença 2000). However, the agricultural frontiers greatly impacted the Chapada dos Veadeiros National Park; areas surrounding the park are currently undergoing an expansion of soybean farms, an intensive extraction

of plants for craft works, and the devastation of forests on mesotrophic soils (Felfili et al. 2007). Thus, the Chapada dos Veadeiros region might play a fundamental role on the conservation of diversity of the Malpighiaceae within Cerrado remnants in Central Brazil.

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